RS&H

March 2026

Ted Stevens Anchorage International Airport
Master Plan Update
Appendix D – Airfield Capacity Analysis

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Prepared by RS&H, Inc. at the direction of
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APPENDIX D

Airfield Capacity Assessment

D.1 Analysis Overview

Fast-time computer simulation was used to analyze the operation of Ted Stevens Anchorage International Airport (ANC, or the Airport) in future conditions with greater numbers of aircraft operations and changes in locations of aircraft handling infrastructure. AirTOP was used to complete this analysis.

AirTOP fast-time simulation modeling is a high fidelity, rule-based approach to analyzing airport and airspace operations by simulating aircraft and air traffic control processes at speeds much faster than real time. Using detailed operational logic and real-world inputs such as flight schedules, procedures, infrastructure layouts, and airspace rules, AirTOP allows planners to run hours or days of operations in minutes to test "what if" scenarios. This enables rapid evaluation of capacity, delay, throughput, controller workload, and system performance across terminal, airside, runway, and airspace environments, supporting informed planning and investment decisions without disrupting live operations.

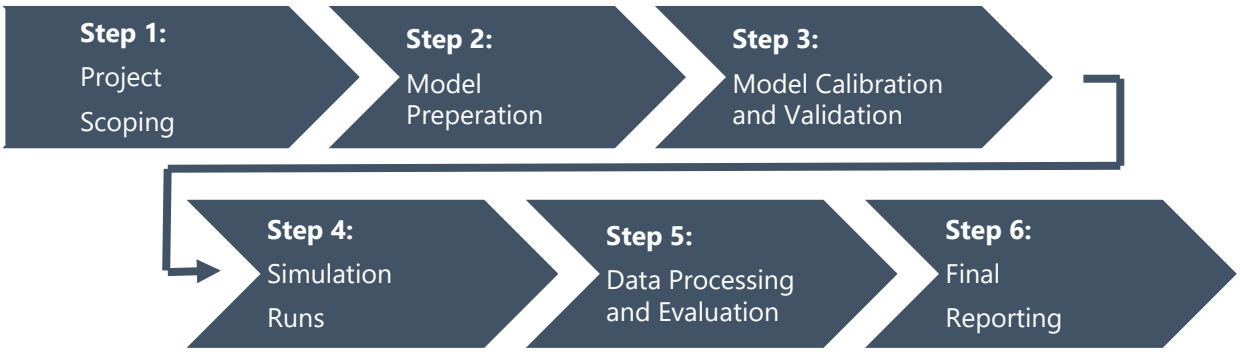
The previous ANC Master Plan, completed in 2014, evaluated Airport runway capacity and included a runway capacity preferred alternative to be implemented at a future level of demand. The analysis completed as part of this Master Plan did not re-evaluate runway capacity. Instead, AirTOP was used to evaluate the performance of the Airport's taxiways and aircraft gate locations with the existing three-runway airfield.

The airfield analysis specifically evaluated changes and additions to the taxiway system to serve aircraft parking and servicing facilities in the West Airpark and South Airpark and evaluated additional taxiways to serve more aircraft taxi operations in all areas of the Airport.

The simulation results demonstrated that the existing three runway airfield can continue to operate at an acceptable level of efficiency with planned cargo developments in the South Airpark and West Airpark through Planning Activity Level (PAL) 2. The analysis evaluated the existing three runways and taxiway system, including future Taxiway Z, which is under construction. As demand grows beyond PAL 2 and toward PAL 3, congestion and delay will increase, potentially exceeding airline-accepted delay levels during peak periods.

D.2 Simulation Process

The fast-time simulation process used for this study consisted of six steps:



Step 1: Fast-time simulation modeling was included at the project scoping phase when the team determined that there was a need to evaluate how airport operations may be impacted at higher demand levels (e.g. more flights). The scope of work at ANC has an additional focus on taxiway and cargo aircraft parking locations as previous analysis had established the runway system's capacity.

Step 2: The AirTOP model is prepared by building a model of the airport. The initial model included the existing Airport airside infrastructure including runways, taxiways, and aircraft parking locations. The Airport's operational parameters were also loaded into the model based on data collected from Airport operations personnel and air traffic control personnel.

Step 3: The AirTOP model was calibrated using existing data and performance metrics and coordination with air traffic control. An existing 24-hour schedule of aircraft operations was loaded into the model and compared to real-world performance data to confirm that the model accurately represented the function of the Airport.

Step 4: The team ran the simulation of existing and future scenarios. The future scenarios evaluated for ANC are described later in this document. The model runs produced information about airfield operations including delays and queues.

Step 5: The modeling team evaluated data and made comparisons between scenarios. Changes may be made to the scenarios at this stage to resolve identified issues or to accept the results. The results showed positive outcomes and demonstrated that higher levels of demand can be accommodated efficiently; in other cases, they resulted in untenable operational delays and congestion.

Step 6: Reporting of results was completed and documented. Reporting included tables, charts, narratives, imagery, and animations of the model. The planning team used these reports to share information with project stakeholders and make recommendations about what infrastructure or operational changes may be needed for the Airport to operate at an acceptable level of efficiency even with changes in demand levels.

D.3 ANC Master Plan Modeling Approach

The Master Plan included use of fast-time simulation modeling to evaluate anticipated growth in operations with the Airport's existing three runways. This reflects the results of a previously completed fast-time simulation analysis of the runway capacity of ANC. This analysis was part of the previous ANC Master Plan, completed in 2014. The 2014 analysis determined that the three-runway system would experience untenable delays when annual operations reach approximately 260,000. The previous study included extensive airline engagement, and the airlines involved determined that regular delays in excess of 30 minutes during peak periods would not be acceptable. That analysis was used to evaluate future runway capacity alternatives and resulted in planning to protect land to construct a second north-south parallel runway would be the most economical solution to serve long-term capacity needs. This Master Plan Update did not seek to re-evaluate that result.

In contrast, this Master Plan evaluated the ability of the existing three runways to accommodate growth and changes to aircraft parking areas and taxiways. This analysis was conducted when the Airport was experiencing a surge in air cargo demand during and after the COVID pandemic as well as growing interest from third-party developers to lease land and build new facilities at ANC to serve the air cargo industry.

The proposed cargo developments are located in the South Airpark, West Airpark, and North Airpark. Cargo operations had not previously been accommodated in the South and West Airparks. ANC was also in the design phase for a new full-length parallel taxiway south of Runway 7R-25L, identified as Taxiway Z. The new taxiway and proposed cargo infrastructure would change operations at ANC. The model was used to identify potential areas of congestion and plan infrastructure improvements, namely taxiways, to avoid untenable levels of congestion on the taxiway system.

The model analyzed airfield configurations and measured hourly and annual delays with planned cargo facility developments and new taxiways. The approach for this study included:

- Evaluating the operational impact of cargo activity in the West and South Airparks
- Evaluating the operational benefit of new taxiways
- Determining if the existing airfield can accommodate planned cargo developments
- Identifying whether additional taxiway infrastructure could address congestion identified in the no-action scenarios

The results evaluated congestion and delay impacts that would result from changes to taxiway and cargo parking infrastructure.

D.4 Modeling Inputs

D.4.1 Design Day Flight Schedule

A design day flight schedule (DDFS) is a detailed, time-sequenced representation of aircraft operations on a representative busy day used for airport planning and capacity analysis. Rather than reflecting the absolute peak or an average day, the design day is selected to typify high-demand conditions that drive facility and operational requirements. The schedule specifies individual arrivals and departures by time of day, aircraft type, airline, and operational characteristics, and is used as a core planning input to evaluate airfield, terminal, gate, and airspace performance under realistic stress conditions. By translating long-term traffic forecasts into an operationally credible daily profile, a DDFS allows planners to test infrastructure needs, identify constraints, and assess future improvements using consistent, repeatable demand assumptions.

The average day of the peak month in 2022 was used as the design day to prepare the DDFS for ANC. The peak month at ANC is traditionally a summer month. The peak month in 2022 was June. Thursday, June 23rd, 2022, was selected to be the base year design day which corresponds to an average day during the peak month. A future DDFS was prepared from the baseline schedule to represent activity on the peak day during PAL 1 through PAL 3.

The corresponding annual, design day, and peak hour operations associated with the four DDFS used for this analysis and summarized in the table below.

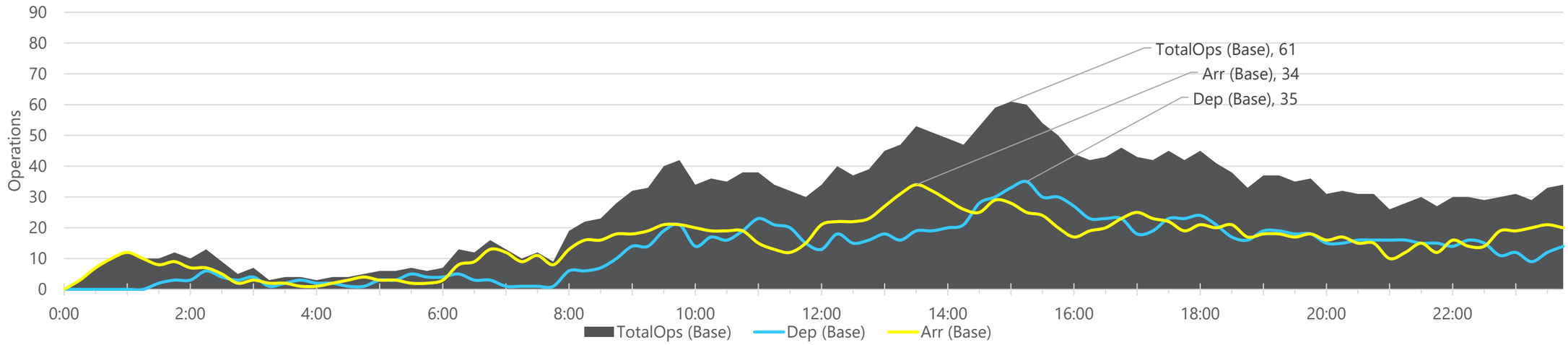
Table D-1
Design Day Flight Schedule Operations Summary

Demand Level	Baseline	PAL 1	PAL 2	PAL 3
Annual Operations	226,346	251,260	276,414	325,775
Design Day Operations	744	824	904	1,058
Peak Hour Operations	61	66	74	82

Source: RS&H, 2023

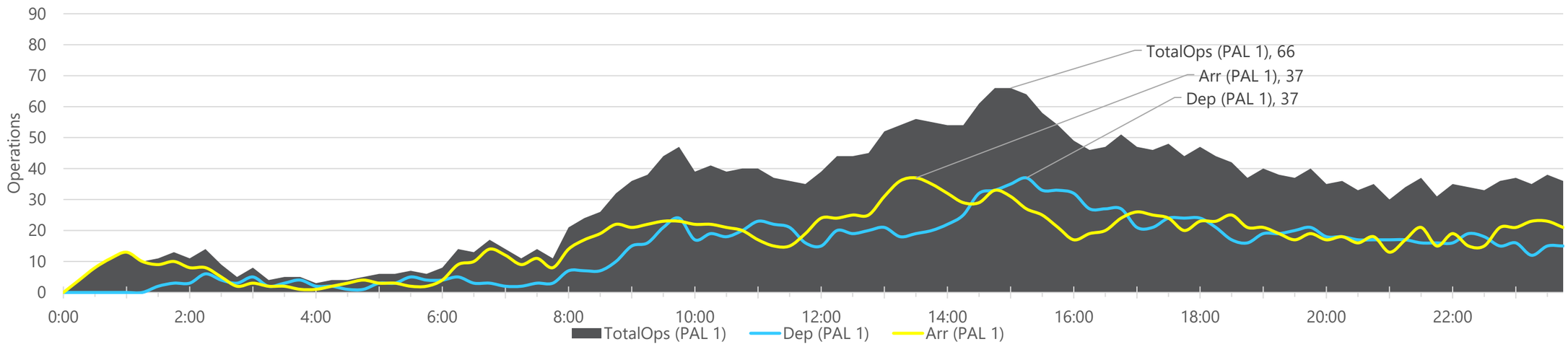
The baseline DDFS and three PAL schedules are presented in **Figure D-1**, **Figure D-2**, **Figure D-3**, and **Figure D-4**. The charts illustrate how operations are spread throughout the 24-hour operating day at ANC. The x axis of the charts represents a 24-hour period of time while the y axis illustrates the number of operations each hour. The grey background shows total operations while the blue and yellow lines illustrate arrivals and departures. These charts illustrate that most activity occurs throughout the daytime from about 8:00 AM to roughly 10:00 PM with the busiest period in the mid-afternoon between about 2:00 PM and 4:00 PM. This general distribution of activity is forecast to remain fairly constant in future years, though there is some spreading of activity that will result in busy periods occurring throughout more of the 24-hour operating day.

Figure D-1
Design Day Operations – Baseline PAL Demand



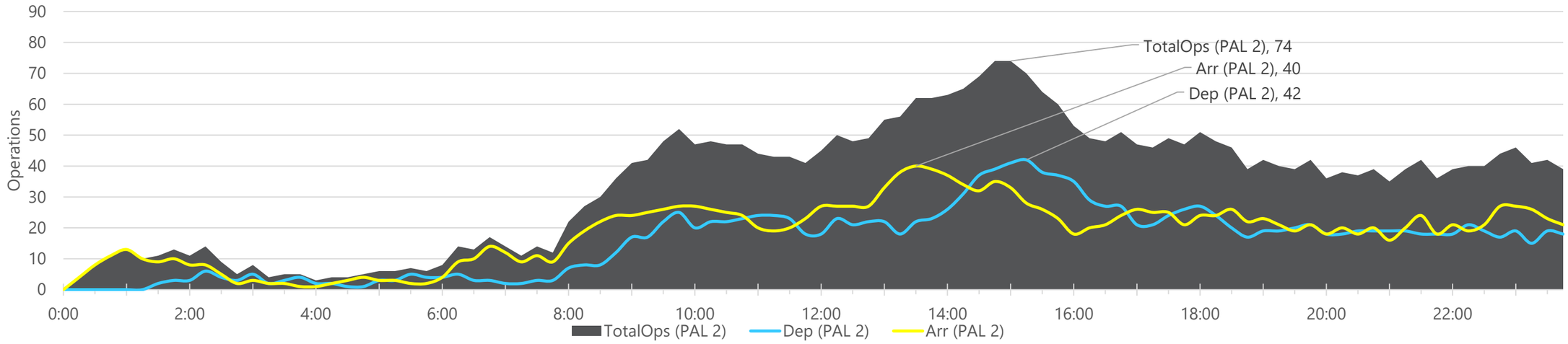
Source: RS&H, 2023

Figure D-2
Design Day Operations – PAL 1 Demand



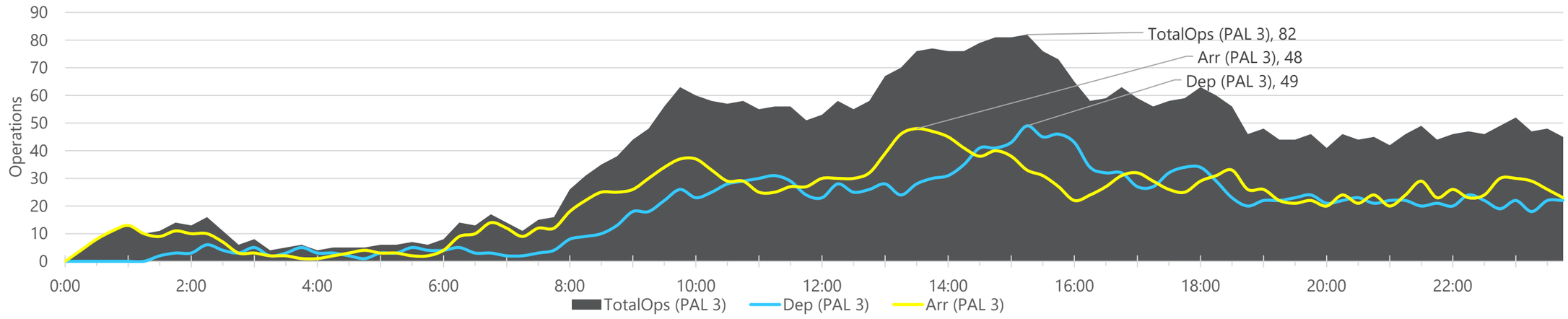
Source: RS&H, 2023

Figure D-3
Design Day Operations – PAL 2 Demand



Source: RS&H, 2023

Figure D-4
Design Day Operations – PAL 3 Demand



Source: RS&H, 2023

D.4.2 Fleet Mix

General Definition and Role in Airport Planning

In airport planning, fleet mix refers to the distribution of aircraft types operating at an airport, typically categorized by aircraft size, weight class, performance characteristics, and operational role (e.g., passenger, cargo, general aviation). Fleet mix is a foundational input to airfield planning because different aircraft impose very different demands on runways, taxiways, aprons, and air traffic control procedures. A small regional turboprop, a narrowbody jet, and a large widebody freighter may all count as a single operation in a forecast, but each affects airfield performance in distinct ways.

Because of these differences, fleet mix is not simply descriptive—it directly influences how efficiently an airport can process aircraft movements. As demand grows, the interaction between aircraft types becomes increasingly important in understanding when and where congestion, delay, or operational constraints will occur.

Importance of Fleet Mix in Capacity and Delay Analysis

Fleet mix is a critical factor in analyzing airport capacity and delay because aircraft size and performance drive many of the underlying mechanisms that limit throughput. Larger and heavier aircraft generally require greater runway occupancy times, increased wake turbulence separation, wider taxiway separations, and more complex gate and apron layouts. Conversely, smaller aircraft may operate more quickly but can be constrained when mixed with heavier aircraft that dictate conservative spacing and sequencing rules.

In capacity analysis, these effects manifest in both airside and ground operations. On the runway system, fleet mix influences arrival and departure spacing, runway crossing opportunities, and achievable peak-hour throughput. Taxiway systems are affected by taxi speeds, passing opportunities, and the ability to route aircraft efficiently without conflicts. When fleet mix is not properly represented, capacity analyses can either overstate or understate actual performance, leading to misleading conclusions about delay and the need for infrastructure improvements.

Fleet Mix in Fast-Time Simulation Modeling (AirTOP)

Fast-time simulation tools such as AirTOP explicitly incorporate fleet mix as a core modeling input. The model assigns performance characteristics, such as speed profiles, runway occupancy times, separation requirements, and taxiing behavior, based on aircraft class or specific fleet categories. This allows the simulation to capture the dynamic interactions between different aircraft types operating simultaneously on the airfield.

In AirTOP, fleet mix affects how aircraft are sequenced on runways, how they interact at taxiway intersections, and how congestion propagates through the system during peak periods. The

resulting delay metrics and capacity estimates therefore reflect not just the volume of operations, but the realism of how those operations actually occur. For airports with complex or non-standard operating environments, accurate representation of fleet mix is essential to producing credible results.

Fleet Mix Characteristics at Ted Stevens Anchorage International Airport
Ted Stevens Anchorage International Airport (ANC) has a distinctive fleet mix that differs markedly from many large U.S. commercial service airports. A defining feature of ANC's operation is its substantial volume of air cargo traffic, including frequent operations by very large widebody freight aircraft serving long-haul international and trans-Pacific routes. These aircraft have significant impacts on runway occupancy, wake turbulence separation, and taxiway utilization, and they strongly influence practical airfield capacity.

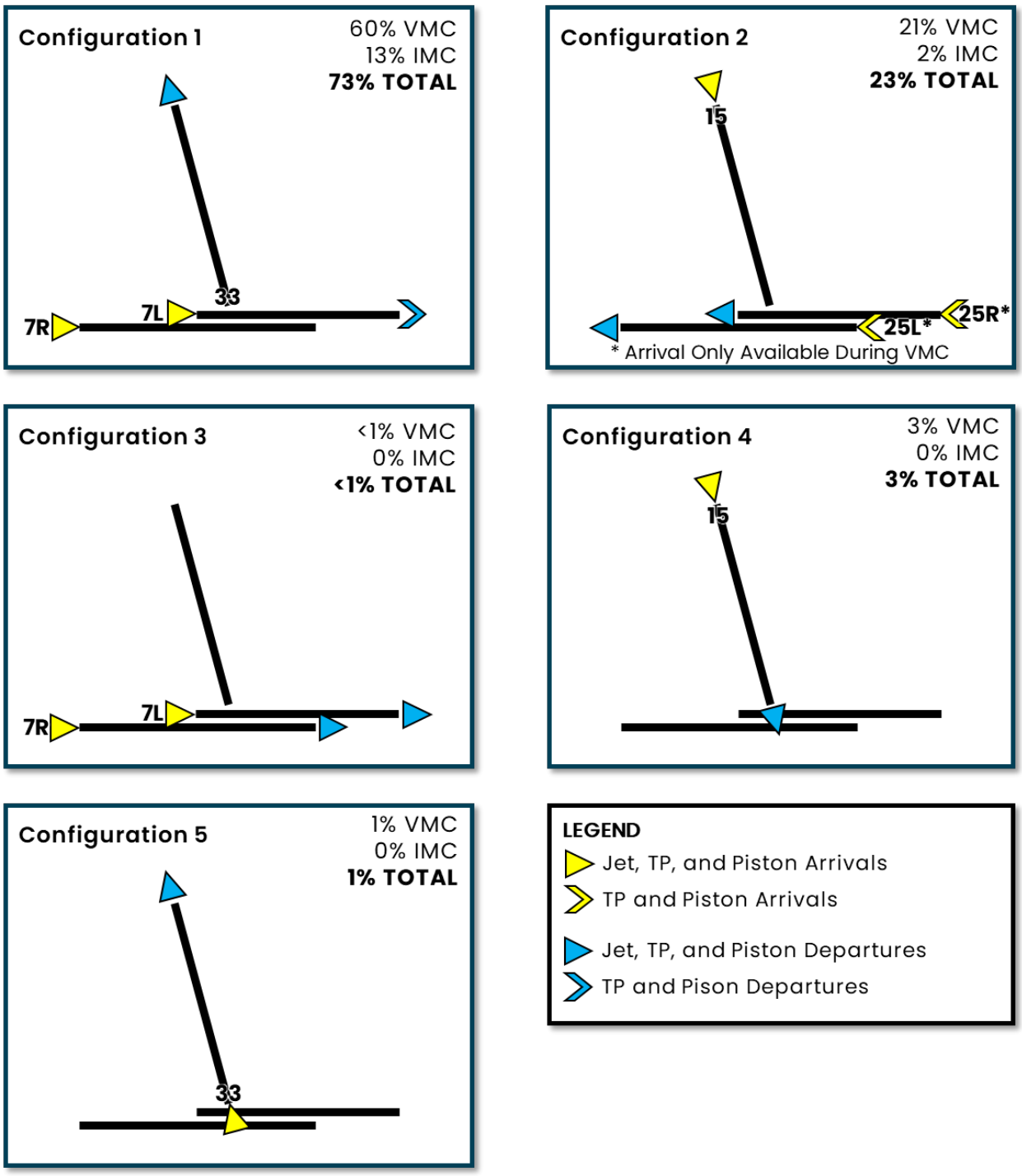
In addition to international cargo operations, ANC supports a diverse group of intrastate cargo carriers that provide air service to rural communities throughout Alaska. Many of these operators rely on vintage and specialized aircraft, including classic piston and turboprop types such as DC-6s, to transport food, fuel, and other critical goods to communities not accessible by road. These aircraft have different performance characteristics, taxi speeds, and operational needs than modern jet aircraft, further increasing the complexity of the overall fleet mix at ANC.

Application to the Anchorage Master Plan Airfield Analysis
These fleet mix characteristics were considered in the preparation of the Anchorage International Airport Master Plan airfield capacity and delay analysis. The AirTOP modeling effort incorporated the unique blend of large international freighters, domestic passenger aircraft, and intrastate air carrier fleets to ensure that runway, taxiway, and apron performance was evaluated under realistic operating conditions. This analysis accounts for this diverse fleet mix, providing a more accurate assessment of capacity, delay, and the benefits of proposed airfield improvements, supporting informed decision-making for the Airport's long-term development.

D.4.3 Airfield Configurations

The airfield at Ted Stevens Anchorage International Airport (ANC) is comprised of three runways and three primary taxiways that support a range of operating configurations driven primarily by wind conditions and weather. Runway 15-33 is served by parallel Taxiway R to the east and Taxiway Y to the west. Runway 7L-25R is served by parallel Taxiway K to the north, while Runway 7R-25L does not currently have a parallel taxiway. The absence of a parallel taxiway on Runway 7R-25L is an important operational consideration and influences how that runway is used within several configurations. The five main runway use configurations are shown in **Figure D-5** and described below.

Figure D-5
Runway Use Configurations



Source: RS&H, 2024
Note: Runway Use configuration percentages determined using NOAA hourly meteorological data collected by ANC ASOS from 2010-2022 and based on conditions described in ANC ATCT Standard Operating Procedures

A review of National Oceanic and Atmospheric Administration (NOAA) wind data and Air Traffic Control (ATC) standard operating procedures (SOPs) indicates that prevailing winds at ANC are typically from the east-southeast. As a result, the Airport most frequently operates in **Configuration 1**, which is used approximately 73 percent of the year, including 60 percent in Visual Meteorological Conditions (VMC) and 13 percent in Instrument Meteorological Conditions (IMC)**.** Under Configuration 1, arrivals predominantly utilize Runways 7L and 7R, while departures operate from Runways 7L and 33. This configuration allows the Airport to take advantage of its intersecting runway system to accommodate high arrival and departure volumes simultaneously, particularly during peak cargo and passenger periods. Configuration 1 represents the Airport's primary and most operationally efficient runway use pattern and serves as the baseline condition for capacity and delay analysis.

When wind direction or operational constraints limit the use of Runways 7L and 7R for arrivals, the Airport transitions to **Configuration 2**, which is used approximately 23 percent of the year, consisting of 21 percent VMC and 2 percent IMC conditions. In Configuration 2, arrivals are conducted on Runway 15, while departures utilize Runways 25R and 25L**.** Due to visibility and separation requirements, Runways 25R and 25L are available for arrivals only during VMC in this configuration for turboprop and piston operations, as indicated in Figure D-5. Configuration 2 is the most common alternative operating condition and maintains a relatively high level of throughput, though with increased dependency on weather conditions and greater interaction between arriving and departing aircraft on intersecting runways.

Configuration 3 is used less than 1 percent of the year and occurs almost exclusively during VMC, with negligible use during IMC. In this configuration, winds dictate exclusive east flow operations, resulting in both arrivals and departures utilizing Runways 7L and 7R. Configuration 3 is also implemented during periods when Runway 15-33 is unavailable, such as during maintenance or construction activities, requiring all aircraft operations to be consolidated onto the east–west runway system. While this configuration supports continued Airport operations under constrained conditions, it offers reduced operational flexibility and capacity compared to the primary configuration due to the lack of a parallel taxiway on Runway 7R-25L and increased interaction between arriving and departing traffic.

Configuration 4, referred to as south flow, is used approximately 3 percent of the year, entirely during VMC. This configuration is driven by strong southerly winds that require all arrivals and departures to operate on Runway 15. Under south flow conditions, the intersecting runway system is not utilized for aircraft movements, and operations are concentrated on a single runway. As a result, Configuration 4 is operationally restrictive and supports lower throughput than configurations that allow simultaneous arrival and departure streams. Its use is generally limited to periods of sustained southerly winds when safety considerations necessitate aligned

runway operations. It's important to note that use of Configuration 4 has become slightly more common over the past decade and may reflect an increase in southerly wind patterns at the Airport.

Configuration 5 is the least frequently used runway use pattern, representing approximately 1 percent of use per year and exclusively in VMC. In this configuration, arrivals use Runway 33, while departures operate from Runway 7L-25R. Configuration 5 is typically associated with strong northerly wind conditions and is operationally less efficient than the primary configurations due to increased runway crossing movements and reduced flexibility for simultaneous arrivals and departures.

Together, these five operating configurations reflect the full range of wind, weather, and operational conditions experienced at ANC throughout the year. The relative frequency of each configuration, along with their differing runway assignments and weather dependencies, was explicitly incorporated into the airfield capacity and delay analysis. Configuration 1, with other configurations used as required outlined in **Figure D-5**, shape airfield performance and capacity, and inform the development and evaluation of airfield improvements considered in the Anchorage Master Plan Update.

D.4.4 Runway Use Configurations and Annual Delay Calculation

In fast-time airfield simulation modeling, runway use configurations are not evaluated in isolation; rather, each configuration is simulated separately and then combined in a weighted framework to reflect how the Airport operates over the course of a typical year. At Ted Stevens Anchorage International Airport (ANC), the runway use configurations described previously were derived from a review of NOAA wind data and ATC standard operating procedures and represent the set of operating conditions that occur throughout the year. These configurations form a fundamental input to the AirTOP simulation modeling process.

For the AirTOP analysis, each runway use configuration is modeled independently under both Visual Meteorological Conditions (VMC) and Instrument Meteorological Conditions (IMC), where applicable. Within each simulation, aircraft operations are assigned to runways consistent with the configuration definition, and aircraft movements are simulated across the runway, taxiway, and apron system. The model captures operational interactions such as runway sequencing, runway crossings, taxiway conflicts, and queue formation, and reports delay metrics on a per-aircraft basis for each configuration and weather condition.

The output of these simulations includes measures such as average peak-hour delay, average daily delay, and average delay per aircraft for each configuration. Some runway use configurations, particularly those that concentrate arrivals and departures on a single runway or

limit simultaneous operations, can produce relatively high delay values during the periods in which they are active. For example, configurations that require all aircraft to arrive and depart on Runway 15 or that eliminate the use of intersecting runways tend to experience increased queuing and reduced throughput compared to the primary operating configuration. These effects are fully reflected in the configuration-specific delay results generated by the model.

To determine average annual delay, the configuration-specific delay results are then weighted by the percentage of time each configuration is used over the course of a year. This weighting process ensures that the annual delay metric reflects not only how much delay occurs under a given configuration, but also how frequently that configuration occurs in practice. As a result, configurations that produce high delays but are used infrequently have a proportionally smaller influence on the annual delay outcome than configurations that are used more often.

For example, Configuration 4 (south flow) results in relatively high delay because all arrivals and departures are constrained to Runway 15, significantly reducing airfield capacity. However, this configuration is used only approximately 3 percent of the year, and therefore its contribution to the average annual delay is limited. In contrast, Configuration 1, which represents the Airport's primary operating condition and is used approximately 73 percent of the year, has a much greater influence on annual delay results. Even modest increases in delay under Configuration 1 can outweigh higher per-operation delays experienced under infrequently used configurations.

By combining configuration-specific delay results using observed runway use frequencies, the AirTOP analysis produces an annualized delay metric that accurately reflects real-world Airport operations. This approach ensures that the airfield capacity and delay analysis accounts for both operational variability and the relative likelihood of each runway use configuration, providing a balanced and realistic assessment of airfield performance to support decision-making in the Anchorage Master Plan.

D.4.5 Aircraft Separation

General Role of Aircraft Separation

Aircraft separation is one of the most fundamental drivers of runway capacity and delay. In-trail separation refers to the minimum spacing required between successive arriving aircraft on the same runway or arrival stream to maintain safe operations. This spacing is governed by a combination of wake turbulence standards, aircraft performance characteristics, air traffic control procedures, and prevailing weather conditions. Because runway arrivals typically represent the most constrained element of airfield operations, in-trail separation directly limits the maximum number of aircraft that can land per hour and strongly influences congestion and delay.

When separation requirements increase, arrival throughput decreases. This reduction in arrival capacity can quickly propagate through the airfield system, resulting in airborne holding, extended approach spacing, increased runway occupancy conflicts, and secondary delays to departures that must wait for arrival gaps. Conversely, tighter separation standards, when safely achievable, allow higher arrival rates and more efficient use of runway infrastructure.

Separation Standards Under VMC and IMC

Arriving aircraft separation varies significantly between Visual Meteorological Conditions (VMC) and Instrument Meteorological Conditions (IMC). Under VMC, controllers may apply visual separation techniques that allow reduced spacing between aircraft, particularly when aircraft are in sight of one another and runway occupancy can be visually confirmed. Under IMC, separation must rely solely on instrument procedures and radar-based standards, which generally require greater spacing between arrivals.

As a result, airports often experience lower arrival capacity and higher delay during IMC even when demand remains unchanged. In fast-time simulation modeling, this distinction is explicitly captured by applying different arrival separation assumptions for VMC and IMC scenarios, allowing the model to reflect realistic degradation in performance during adverse weather conditions.

Influence of Aircraft Weight Class and Performance

In addition to weather, aircraft weight class and performance play a critical role in determining arrival separation. Larger and heavier aircraft generate stronger wake turbulence, requiring greater spacing for following aircraft, particularly when the trailing aircraft is lighter or slower. Differences in approach speed further complicate sequencing, as slower aircraft increase runway occupancy time and may force larger gaps in the arrival stream to maintain safe spacing.

As a result, an airport's fleet mix is inseparable from its arrival capacity. Airports with a homogeneous fleet of similar aircraft types can often achieve more consistent arrival rates, while airports with a diverse mix of heavy, large, and small aircraft tend to experience more variable spacing and reduced throughput during peak periods.

Arriving Aircraft Separation at Anchorage International Airport

ANC presents a particularly complex arrival separation environment due to its diverse fleet mix. As documented in the Anchorage Master Plan airfield capacity assessment, ANC accommodates a substantial volume of large and heavy widebody aircraft, primarily associated with international and long-haul air cargo operations. These aircraft frequently operate at or near maximum landing weights and require increased wake turbulence separation when followed by other aircraft.

At the same time, ANC supports a wide range of smaller and slower aircraft, including narrowbody passenger aircraft, turboprops, and intrastate cargo aircraft serving rural communities throughout Alaska. Many of these aircraft have lower approach speeds and different performance characteristics than the heavy freighters that dominate peak cargo periods. The interaction between these aircraft types increases the complexity of arrival sequencing and can further reduce effective runway capacity.

The ANC AirTOP modeling accounted for these fleet mix characteristics by applying arrival separation assumptions that vary by aircraft category and weather condition, reflecting the increased spacing required when heavy aircraft are present in the arrival stream and when instrument conditions prevail. This information forms a key input to the simulation and directly influences modeled arrival rates and delay outcomes.

Representation in Fast-Time Simulation Modeling

In the AirTOP fast-time simulation, arriving aircraft separation is implemented as a governing constraint on runway throughput. Aircraft are introduced into the arrival stream according to the forecast schedule and fleet mix, and the model enforces minimum in-trail separation based on the applicable separation rules for the aircraft pair and weather condition. When demand exceeds the achievable arrival rate, the model generates delay in the form of airborne holding or extended approach spacing, which is then recorded in the delay metrics.

Because ANC experiences frequent operations by heavy aircraft, periods dominated by cargo arrivals tend to exhibit greater separation requirements and lower arrival capacity than periods dominated by lighter aircraft. This effect is particularly pronounced during IMC, when visual separation cannot be applied and conservative spacing standards govern all arrivals. The simulation captures these dynamics by applying different separation assumptions for VMC and IMC scenarios within each runway use configuration.

Implications for Capacity and Delay Results

The combined effect of heavy aircraft prevalence, mixed approach speeds, and weather-dependent separation standards means that arriving aircraft separation is one of the primary contributors to delay at ANC during peak periods. While the Airport's runway system provides flexibility through intersecting runways and multiple operating configurations, arrival separation often becomes the binding constraint that limits throughput before physical runway geometry does.

Importantly, the AirTOP analysis evaluates these effects within the broader framework of runway use configuration frequency. Configurations and conditions that produce higher arrival

separation requirements may generate substantial delay while they are active; however, their influence on average annual delay is moderated by how often those conditions occur. This ensures that the capacity and delay results reflect the operational reality of ANC rather than isolated worst-case scenarios.

Summary of Fleet Mix

Arriving aircraft separation is a critical determinant of airfield capacity and delay, particularly at airports with diverse fleet mixes and a high proportion of heavy aircraft. At ANC, the prevalence of large widebody cargo aircraft, combined with slower intrastate aircraft and frequent IMC operations, results in increased separation requirements that directly constrain arrival throughput. These factors were incorporated into the AirTOP modeling through configuration-specific and weather-specific arrival separation assumptions, ensuring that the airfield capacity and delay analysis accurately reflects the operational characteristics of ANC and provides a defensible basis for master plan decision-making.

D.5 Model Calibration

Representation of Existing Airfield Conditions

The first step in the modeling process is the development of a baseline model that accurately represents existing airfield conditions at ANC. This includes coding the current runway system, taxiway geometry, apron areas, and aircraft parking locations as they exist at the time of the analysis. All modeled infrastructure reflects current airfield geometry, including the configuration of the three-runway system, the location and connectivity of primary taxiways, and operational constraints such as the absence of a parallel taxiway on Runway 7R-25L.

In addition to physical infrastructure, the baseline model incorporates operational assumptions derived from the Master Plan inventory and facility requirements tasks. These assumptions include runway use configurations, fleet mix, arrival separation standards, and general aircraft ground movement patterns. Collectively, these inputs establish a model environment that mirrors how aircraft operate at ANC under current conditions and provides the foundation for subsequent calibration and validation activities.

Development of the Baseline Schedule

Once the physical and operational framework of the model is established, a baseline flight schedule is developed to represent existing levels of demand. For the ANC Master Plan Update, this baseline reflects current annual operations and a representative design-day demand profile, including the mix of passenger, cargo, general aviation, and other aircraft types. The schedule captures the temporal distribution of arrivals and departures throughout the day and is consistent with observed peak-hour activity levels at the Airport.

The baseline schedule is a critical calibration input because it allows the model to simulate real-world operating conditions rather than theoretical or unconstrained demand. By running the model with an observed demand level, the simulation produces delay and throughput results that can be directly compared to how the Airport performs in practice. This comparison is central to determining whether the model is behaving realistically.

Initial Model Runs and Review of Results

With the baseline schedule in place, the model is executed to generate initial simulation results. These early runs are used to identify whether aircraft movements, runway utilization, and taxiway flows behave in a manner consistent with expectations. Key outputs reviewed during this stage include runway throughput, taxiway congestion points, and general patterns of delay formation across the airfield.

At this stage, the objective is not to fine-tune results to achieve a specific delay value, but rather to confirm that the model reflects the operational logic of the Airport. Any discrepancies between modeled behavior and known operating practices are flagged for further review and refinement during the calibration process.

Coordination with Airport Operations and Air Traffic Control

A central element of the calibration process at ANC involved direct coordination with Airport operations personnel and air traffic control (ATC) staff. These discussions are essential to understanding how aircraft are actually handled on the airfield, beyond what can be inferred from geometry and schedules alone. Airport operations staff and controllers provided insight into runway use preferences, taxi routing practices, runway exit usage, and procedures applied during different weather and traffic conditions.

This coordination ensures that the model reflects local operating practices, including nuances that may not be formally documented but materially influence airfield performance. Incorporating this operational knowledge strengthens the credibility of the simulation and helps ensure that the model is aligned with day-to-day realities at ANC.

Use of Model Animations for Calibration

An important component of the calibration effort involved sharing the model with air traffic control personnel to review simulation animations. The animated outputs allow controllers and Airport staff to visually observe how aircraft move through the modeled airfield, including runway sequencing, taxi routing, and interactions at key nodes.

These animation reviews provide an effective platform for discussion and feedback. Controllers are able to identify areas where aircraft handling differs from real-world practice and to ask

questions about specific modeling assumptions. In response, the modeling team can adjust parameters such as taxi routes, runway exits, or sequencing logic to better reflect actual operations. This iterative review process is a critical step in refining the model and resolving detailed questions related to aircraft handling.

Completion of Calibration and Validation

The calibration process concludes once the baseline demand level is run through the model and the resulting outputs are judged to be a reasonable and accurate reflection of real-world operating conditions at ANC. At this point, modeled runway utilization, congestion locations, and delay patterns are consistent with observed airport performance and with the operational experience of Airport staff and air traffic control personnel.

A successfully calibrated model does not eliminate all delay; rather, it reproduces delay in a manner that reflects how and where it occurs in practice. Achieving this level of realism is essential before the model can be confidently used to test future demand levels or evaluate alternative airfield configurations. With calibration complete, the model provides a robust and defensible tool for assessing airfield capacity and delay as part of the Master Plan Update.

D.6 Airfield Simulation – Baseline Configuration Analysis

With the model calibrated to accurately represent existing airfield geometry, operational procedures, and baseline levels of demand, the next step in the analysis is the baseline configuration analysis. The purpose of this analysis is to evaluate how forecast levels of demand, represented by the future Design Day Flight Schedules (DDFS), operate on the existing airfield configuration, including infrastructure that is already planned or programmed for construction at ANC, such as reconfigured Taxiway Z.

This analysis does not assume new or speculative infrastructure improvements beyond those already committed or reasonably expected to be in place as demand increases. Instead, it is intended to identify where and how the current system begins to experience stress as operations increase, and to isolate locations where congestion and delay begin to materialize under higher demand levels.

Application of Forecast Demand Levels

The baseline configuration analysis evaluates future demand levels PAL 1, PAL 2, and PAL 3, which each have progressively higher levels of annual and peak-period aircraft activity. For each Planning Activity Level, the calibrated model is run using the corresponding DDFS, shown in **Figure D-2**, **Figure D-3**, and **Figure D-4** to simulate how aircraft operate on the airfield under increasing levels of demand.

The model is executed multiple times at each demand level to account for variability in runway use configurations, weather conditions, and operational interactions as described in Section D.4, *Modeling Inputs*. This approach ensures that the resulting delay and congestion metrics are representative of expected conditions rather than isolated outcomes from a single simulation run. Results from each PAL build upon the previous level, allowing the analysis to clearly illustrate how incremental increases in demand translate into increased congestion and delay.

Inclusion of Planned Infrastructure

A critical element of the baseline configuration analysis is the inclusion of infrastructure that was already planned or under development at ANC, even though it was not present in the 2022 baseline condition. This ensures that the analysis reflects the most realistic future operating environment rather than overstating constraints that are already programmed to be addressed. For the PAL 1 analysis, which corresponds to approximately 2027, the model includes the South Airpark cargo facility and its 15 cargo aircraft positions. These positions are also included in the PAL 2 and PAL 3 analyses, reflecting the assumption that the cargo facility will remain operational as demand continues to grow.

Reconfigured Taxiway Z is another airfield element incorporated into the baseline configuration analysis. In the PAL 1 and PAL 2 models, Taxiway Z would extend the full length of Runway 7R-25L. In PAL 3, an additional connector extending east and around the Runway 25L end and connecting to existing Taxiway B was included. As a result, two concepts for Taxiway Z were included in all future baseline model runs in two phases. This provides a more accurate representation of anticipated aircraft circulation patterns and taxiway connectivity at higher levels of activity.

Identification of Congestion and Delay

As demand increases from PAL 1 through PAL 3, the baseline configuration analysis illustrates how the existing airfield infrastructure begins to experience increasing levels of congestion and delay. At lower demand levels, congestion is limited to short-duration queues or localized areas during the most constrained runway use configurations. These conditions are typically manageable and do not materially affect overall airfield performance.

As demand increases through PAL 2, areas of recurring congestion become more apparent, particularly during constrained operating configurations and peak cargo periods. However, the Airport continues to operate with acceptable delays, with congestion concentrated in predictable locations and limited to specific periods of the day or specific runway use configurations.

At demand levels above PAL 2, and particularly at PAL 3, the analysis shows that congestion begins to intensify and delay becomes a more pervasive operational issue. At this level of activity, the airfield experiences substantial delay, with congestion extending beyond isolated choke points and affecting broader portions of the taxiway and runway system. These conditions indicate that the existing infrastructure, even with planned improvements included, is approaching the limits of its practical capacity.

Chapter 4, Facility Requirements documents that airlines have been consulted since 2013 to understand their acceptable threshold of delay at ANC. The 2013 Alaska International Airport System (AIAS) Plan reported that "untenable delay" occurs when flights are delayed 30 minutes or more during the peak hour more than 10% of the time. **Table D-3** presents the results of the baseline analysis and is discussed in **Chapter 4, Facility Requirements**.

Use of Results to Inform Infrastructure Needs

The primary objective of the baseline configuration analysis is not to prescribe solutions, but rather to identify where congestion occurs and why as demand increases. Areas of recurring or substantial congestion highlighted by the model are carried forward into the master planning process for further evaluation and to enable planners to evaluate potential solutions that alleviate congestion and delay.

For example, planners anticipated that high levels of congestion would occur on the southern half of Taxiway R. This was expected because of the volume of taxiing aircraft moving south from the North Airpark to depart Runway 15, while arriving aircraft are taxiing north to cargo facilities located in the North Airpark. The model did indeed indicate that Taxiway R does become congested at demand levels in excess of PAL 2. In a case like this, the results may suggest the need to evaluate a parallel taxiway or other circulation improvements to allow aircraft to taxi in two directions simultaneously to reduce bottlenecks.

Similarly, congestion near runway crossings, apron access points, or terminal-adjacent taxiways provides insight into where additional infrastructure or operational adjustments may be required as activity continues to grow. These findings form the analytical foundation for subsequent alternatives analysis and infrastructure evaluation within the Master Plan.

Chapter 4, Facility Requirements reports a summary of findings from the baseline model run.

D.6.1 Airfield Overview in Baseline Analysis

The following airfield elements were added to the model to accurately represent planning infrastructure:

- Realigned Taxiway Z – The 2022 ANC airfield includes the legacy Taxiway Z which extended west from Taxiway F and then south and was limited to Airplane Design Group (ADG) III aircraft, such as the Boeing 737. Beginning in 2024, a construction project was begun to realign Taxiway Z so that it would become a full-length parallel taxiway to Runway 7R-25L and accommodate ADG VI aircraft, such as the Boeing 747-8F. The north-south portion of the legacy Taxiway Z was extended across Runway 7R-25L and renamed Taxiway R. The PAL 1 and PAL 2 model included the full parallel Taxiway Z portion along Runway 7L-25R. The PAL 3 model included an eastward extension around the end of Runway 25L connecting with Taxiway B. This segment has been removed from implementation plans since the time of the modeling evaluation and is no longer included in the Airport's capital plan.

- South Airpark cargo facility – A developer has proposed to construct an air cargo apron and support infrastructure in the area west of the existing South Airpark. The development's Environmental Assessment was approved in August 2023 and includes provisions to provide up to 15 cargo hardstands each capable of accommodating large aircraft including Boeing 777 and 747 freighters. The baseline model was run in 2024 and assumed that the facility would be constructed and operating by PAL 1 in 2027, as well as in PAL 2 and PAL 3. The South Airpark cargo facility project is assumed to serve international air cargo tech stop operations.

D.6.2 Parking Position Assignments in Baseline Analysis

All airlines were assigned to use various Airport facilities:

- All passenger airlines were assigned to use the gates at the South and North Terminals. Airline gate assignments were flexible, so airlines were not limited to specific gates. This approach was acceptable for this assignment because a separate gating analysis was completed to evaluate the terminals and their ability to meet forecast demand in future years.

- Integrated carriers including FedEx and UPS were assigned to use the gates at their facilities. As with the passenger airlines, there was not a gate limit placed on these facilities, so all UPS and FedEx flights were able to use their respective facilities without any capacity limitations. This assumption was made to reflect that FedEx and UPS would develop additional aircraft parking positions on land they occupy if their existing facilities cannot accommodate their future schedules.

- Tech stop cargo parking was assigned to the Airport's existing R Spots and P Spots as well as the planned South Airpark cargo facility.

- Other airline activity, such as intrastate cargo, business aviation, and other miscellaneous activity were assigned to their respective locations such as the South Airpark, North Airpark, and East Airpark.

D.6.3 Aircraft Ground Movements in Baseline Analysis

Aircraft ground movements were programmed to represent existing movements. For future infrastructure, such as Taxiway Z, planners worked with air traffic controllers to determine the likely routing they would use once new taxiways were available. Specific changes included routing of cargo aircraft to the planned South Airpark cargo facility. In each configuration, air traffic controllers identified the anticipated routes that would be assigned to arriving and departing aircraft as they move between their arrival runway, the cargo facilities, and the assigned departure runway. The model does make some decisions as needed. For example, as congestion occurs, exit taxiways may not be available requiring the model to route aircraft on available taxi connectors that differ from the normally preferred exit location.

D.6.4 Simulation Results

The baseline configuration analysis uses a calibrated model to evaluate how forecast levels of demand operate on the existing airfield configuration at ANC, including infrastructure that is already planned including Taxiway Z and the South Airpark cargo facility. Demand levels at PAL 1, PAL 2, and PAL 3 identified where congestion and delay begin to materialize and how those conditions evolve as activity increases. The results show that ANC generally operates with acceptable delay through PAL 2, but that substantial delay becomes a concern at PAL 3, particularly under constrained operating configurations. These findings provide a critical basis for identifying and evaluating potential airfield improvements in the master planning process. The baseline airfield simulation results are presented in **Table D-2**.

Figures D-6 and D-7 illustrate one of the key findings from the baseline analysis. In Figure D-6, the conflict between northbound and southbound taxiway traffic on Taxiway R is outlined. There are two taxilanes in the terminal area, Taxilane G1 and Taxilane E, which can be used for northbound traffic. However, these two taxilanes only extend to Taxiway M. At periods of peak demand, a queue for Runway 33 departures builds on Taxiway R to the north as a result of so many cargo aircraft departures from the North Airpark. If the queue extends past Taxiway M, there is no way to route northbound aircraft to the North Airpark. Air traffic controllers can cross aircraft from the North Airpark facilities to Taxiway Y at taxiways S, T, and U. However, each of these crossings requires air traffic control to pause departures on Runway 33 further exacerbating departure delay. At current and near-term traffic levels, air traffic control has workarounds that enable the Airport to continue operating with reasonable levels of peak period delay. However, as demand exceeds PAL 2 and approaches PAL 3, the model indicates

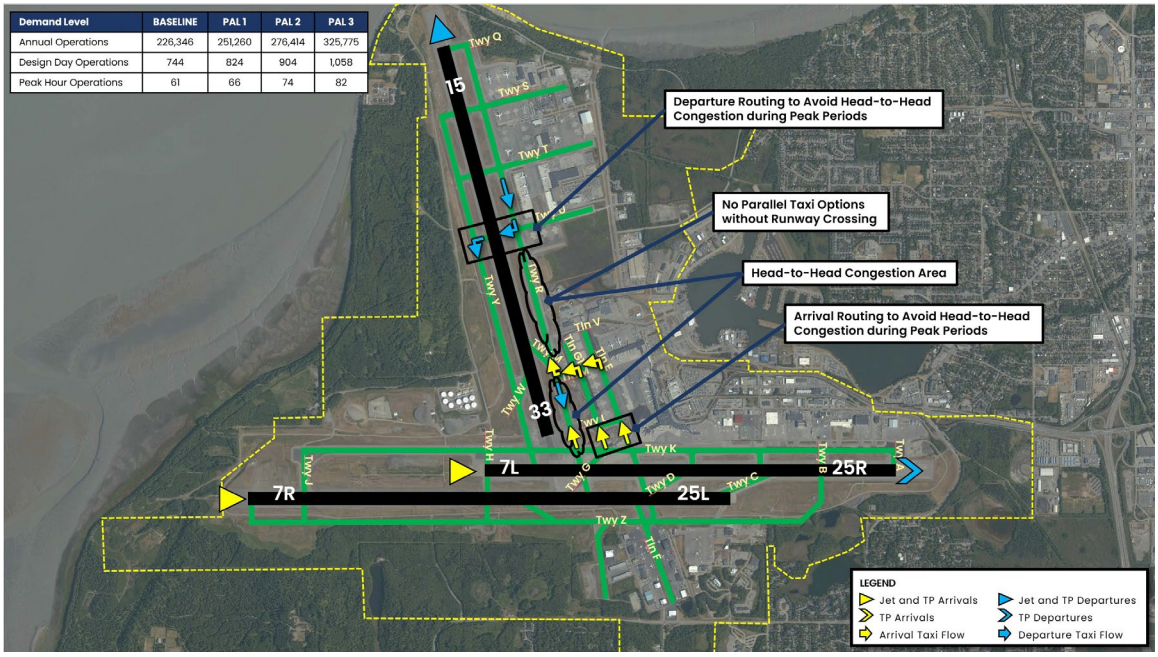
that the routings air traffic control uses today will not be sufficient to maintain delay levels determined to be acceptable to airlines.

As noted earlier in this report, the PAL 3 baseline model included an eastward extension of Taxiway Z around the end of Runway 25L connecting to Taxiway B. This portion of Taxiway Z has since been removed from the Airport's capital plan. Modeling this extension revealed further challenges with such a configuration that identify some general challenges with the existing airfield layout that will need to be addressed at higher levels of demand.

In **Figure D-7**, it's noted that a long line of aircraft builds on Taxiway K east of Taxiway R and south of the passenger terminal and East Airpark. At PAL 3 demand levels, the model preferred to route Runway 7R arrivals to Taxiway Z. Today, aircraft that arrive Runway 7R exit north using Taxiways G, D, or C. Some Runway 7R arrivals do exit to the south if their destination is the South Airpark, however, this is a relatively small percentage of arrivals. In the future condition, the model made use of Taxiway Z and the eastward end-around connection to Taxiway B to prevent arrival delay in the air as aircraft can quickly exit to the south and a queue can build on Taxiway Z prior to crossing the inboard runway, Runway 7L-25R. The model reflects air traffic controller priority to minimize airspace delay and take ground delay due to its lower cost to airlines. Figure D-7 illustrates areas where the number of aircraft on the ground in the central portion of the Airport becomes so congested that gridlock is unavoidable as aircraft queues build on both Taxiway R and Taxiway K.

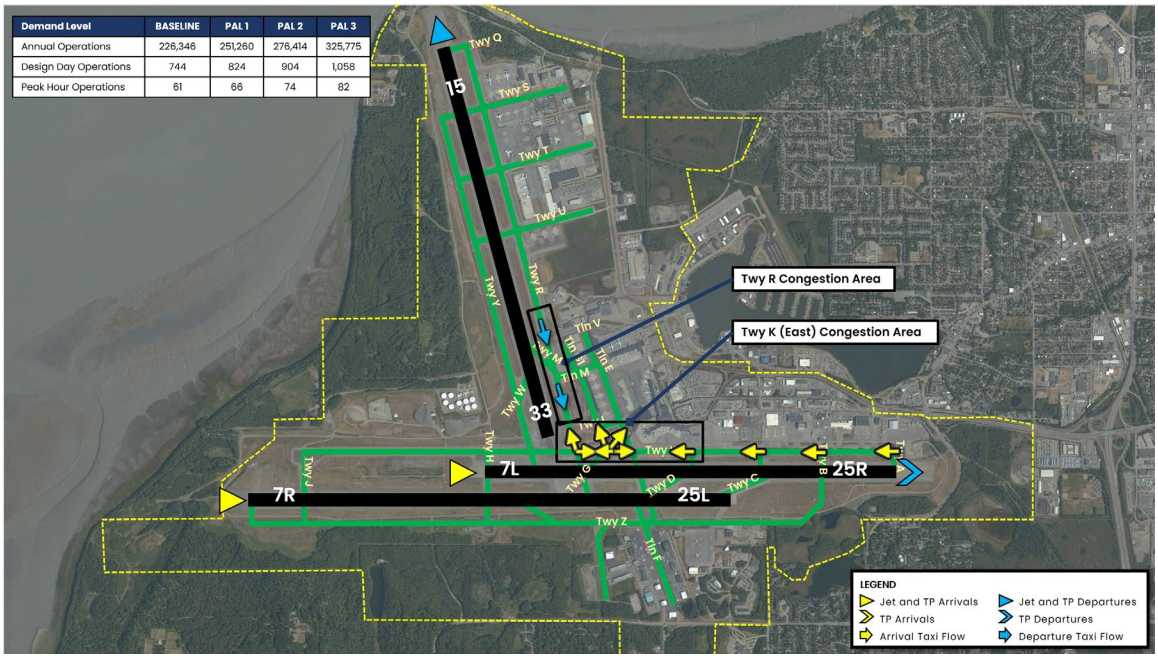
The result of the baseline modeling exercise led planners to prioritize distribution of cargo facilities away from the terminal area and North Airpark and to consider parallel taxiways to provide more flexibility to move aircraft in opposite directions at the same time.

Figure D-6
Baseline Model Congestion in Central Area of Airport


Demand Level | BASELINE | PAL 1 | PAL 2 | PAL 3
Annual Operations | 226,346 | 251,260 | 276,414 | 325,775
Design Day Operations | 744 | 824 | 904 | 1,058
Peak Hour Operations | 61 | 66 | 74 | 82
Departure Routing to Avoid Head-to-Head Congestion during Peak Periods
No Parallel Taxi Options without Runway Crossing
Head-to-Head Congestion Area
Arrival Routing to Avoid Head-to-Head Congestion during Peak Periods
15
33
7L
25R
7R
25L
LEGEND
Jet and TP Arrivals
TP Arrivals
Arrival Taxi Flow
Jet and TP Departures
TP Departures
Departure Taxi Flow

Source: RS&H, 2025

Figure D-7
Baseline Model Congestion on Taxiway R and Taxiway K


Demand Level | BASELINE | PAL 1 | PAL 2 | PAL 3
Annual Operations | 226,346 | 251,260 | 276,414 | 325,775
Design Day Operations | 744 | 824 | 904 | 1,058
Peak Hour Operations | 61 | 66 | 74 | 82
Twy R Congestion Area
Twy K (East) Congestion Area
15
33
7L
25R
7R
25L
LEGEND
Jet and TP Arrivals
TP Arrivals
Arrival Taxi Flow
Jet and TP Departures
TP Departures
Departure Taxi Flow

Source: RS&H, 2025

Table D-2
Baseline Airfield Demand/Capacity Results

Operations Demand			Configuration	Weather	Utilization	Operations Throughput		Average Peak Hour Delay (minutes of delay per aircraft during peak hour)			Average Daily Delay (minutes of delay per aircraft during average day)			Average Annual Delay (annualized minutes of delay per aircraft)
Annual	Design Day	Rolling Peak Hr				Departure	Arrival	Departure	Arrival	Peak Total	Departure	Arrival	Peak Total	
Baseline PAL (2022 Schedule with Existing Airfield)														
226,346	744	61	1	VMC	60%	27	36	3.5	1.7	4.7	0.7	0.3	1.0	**1.3**
			1	IMC	13%	24	35	3.4	2.1	5.5	0.7	0.3	1.1	
			2	VMC	21%	24	30	2.2	3.7	5.4	0.3	0.3	0.6	
			2	IMC	2%	35	24	2.1	4.5	6.6	0.3	0.7	1.0	
			3	VMC	1%	34	36	15.6	2.0	16.7	1.9	0.4	2.3	
			Weighted Delay (min)					**5.7**	**2.4**	**7.6**	**1.0**	**0.3**	**1.3**	
PAL 1 (2027 Schedule with Twy Z + South Airpark Cargo)														
251,260	824	66	1	VMC	60%	33	35	3.3	10.0	10.7	0.5	1.8	2.3	**2.0**
			1	IMC	13%	36	36	12.9	12.5	25.4	0.9	1.9	2.8	
			2	VMC	21%	31	34	4.1	4.0	6.6	0.5	0.7	1.2	
			2	IMC	2%	33	35	2.6	8.2	9.2	0.3	0.8	1.2	
			3	VMC	1%	43	36	9.8	1.9	11.7	0.6	0.3	1.0	
			Weighted Delay (min)					**4.6**	**8.7**	**11.3**	**0.5**	**1.5**	**2.0**	
PAL 2 (2032 Schedule with Twy Z + South Airpark Cargo)														
276,414	904	74	1	VMC	60%	35	43	12.7	7.0	18.8	0.8	1.0	1.8	**1.5**
			1	IMC	13%	37	42	10.1	19.1	20.6	0.2	1.3	1.5	
			2	VMC	21%	38	37	7.2	2.1	8.3	0.5	0.4	0.9	
			2	IMC	2%	36	38	2.6	20.9	22.9	0.3	1.3	1.6	
			3	VMC	1%	43	39	8.7	2.4	11.1	0.7	0.4	1.1	
			Weighted Delay (min)					**10.5**	**7.6**	**16.2**	**0.6**	**0.9**	**1.5**	
PAL 3 (2042 Schedule with Twy Z Including End Around + South Airpark Cargo)														
325,775	1058	82	1	VMC	60%	37	46	44.3	7.6	50.2	4.5	1.3	5.9	**5.4**
			1	IMC	13%	39	43	36.7	21.6	58.2	4.3	2.8	7.1	
			2	VMC	21%	40	47	20.8	16.7	22.2	1.5	1.6	3.1	
			2	IMC	2%	35	46	72.5	30.0	91.1	9.3	1.7	10.9	
			3	VMC	1%	43	45	71.0	10.1	76.7	9.9	1.3	11.2	
			Weighted Delay (min)					**37.5**	**11.5**	**44.6**	**3.8**	**1.5**	**5.4**	

Source: AirTOP; RS&H, 2025

D.7 Airfield Simulation – Alternative Configurations Analysis

D.7.1 Airfield Overview

The baseline analysis identified airfield areas of congestion at ANC, as described in Section D.6.4. The scope of work for the master plan included evaluation of three alternatives using the model. Once the airfield facility requirements, including the baseline demand/capacity analysis, was complete, the planners worked with Airport staff to identify three alternatives for the alternative configurations analysis to be evaluated using the AirTOP model. The broader alternatives analysis for the master plan evaluated multiple detailed. Based on the baseline analysis, the alternatives would evaluate two categories of changes to the Airport:

1) New locations for tech-stop air cargo operations handling
2) New taxiways that may alleviate areas of congestion identified in the baseline analysis

In 2024, when this analysis was underway, the Airport had already entered into lease agreements with at least three private developers interested in building and operating facilities at ANC that would serve international air freight airlines:

- South Airpark cargo facility – This facility was in planning and had received environmental entitlement in 2023. The facility was planned to accommodate up to 15 large cargo aircraft.
- North Airpark cargo facility – This facility was in planning and had received environmental entitlement in April 2024. This facility was planned to accommodate up to eight large cargo aircraft.
- West Airpark cargo facility – This facility had been proposed but was not in active planning at the time the master plan analysis was completed.

ANC Airport was also planning development of Airport-operated cargo hardstands in the West Airpark with parking for at least four large cargo aircraft. The Airport and planning team decided to include the South Airpark, West Airpark and North Airpark Cargo Facilities in various configurations and sizes in the three alternatives. This decision was made to evaluate the impact of new cargo facilities in the West and South Airparks and evaluate how taxi operations would change with cargo activity in these areas. The baseline analysis did include the South Airpark cargo facility but only in its complete buildout with all 15 cargo parking positions. Further, the baseline analysis did not include any cargo activity in the West Airpark.

The addition of a new taxiway parallel to Taxiway R would also be included in one of the alternatives to evaluate its ability to relieve congestion along Taxiway R north of Taxiway K. The

proposed parallel taxiway would extend approximately 4,000 feet north of Taxiway K so as not to conflict with existing lease agreements, which would be impractical to renegotiate and render the analysis less valuable. The inclusion of a new taxiway parallel to Taxiway K was considered. However, constructing a new taxiway north of Taxiway K would have substantial impact on the South Terminal eliminating several passenger aircraft parking positions on the B and C Concourses as shown in **Chapter 5, Alternatives** of the Master Plan document. The consideration of a parallel taxiway at this location was eliminated from consideration as a result of these impacts and was not included in the alternatives.

The elements of each of the three alternatives selected for inclusion in the airfield modeling analysis are described below.

D.7.1.1 Alternative 1

Alternative 1 is depicted in **Figure D-8**. Alternative 1 included the following elements:

- New parallel taxiway east of Taxiway R extending from Taxiway K to north of Taxiway V. This taxiway enables bi-directional flow of aircraft on Taxiway R and the new parallel taxiway. The taxiway does not extend to Taxiway P as a result of a tenant leasehold east of Taxiway R and south of Taxiway P.
- Taxiway Z extends parallel to and along the full length of Runway 7R-25L and a connection to Taxiway H.
- Three P Spot cargo parking positions remain.
- The South Airpark cargo facility provides parking for 15 cargo aircraft.
- New cargo parking is located in the West Airpark along Taxiway Y with parking for nine cargo aircraft.
- The North Airpark cargo facility is located in the North Airpark east of Taxiway R and south of Taxiway P and provides parking for eight cargo aircraft.
- The R Spots and North Terminal are not used for cargo aircraft parking in this alternative.

D.7.1.2 Alternative 2

Alternative 2 is depicted in **Figure D-9**. Alternative 2 included the following elements:

- No new taxiway parallel to Taxiway R.
- Taxiway Z extends from the east end of Runway 7R-25L to Taxiway H only. There is no extension of Taxiway Z west of Taxiway H.
- Three P Spot cargo parking positions remain.
- The South Airpark cargo facility is not included in this alternative.
- New cargo parking is located in the West Airpark along Taxiway Y with parking for nineteen cargo aircraft – 10 more positions than in Alternative 1.

- The North Airpark cargo facility is located in the North Airpark east of Taxiway R and south of Taxiway P and provides parking for eight cargo aircraft.
- Eight existing R Spots remain. R2, R3, and R4 are not used for cargo parking.
- The North Terminal is not used for cargo aircraft parking in this alternative.

D.7.1.3 Alternative 3

Alternative 3 is depicted in **Figure D-10**. Alternative 3 included the following elements:

- No new taxiway parallel to Taxiway R.
- Taxiway Z extends from the east end of Runway 7R-25L to Taxiway H only. There is no extension of Taxiway Z west of Taxiway H.
- Three P Spot cargo parking positions remain.
- The South Airpark cargo facility provides parking for 15 cargo aircraft.
- New cargo parking is located in the West Airpark along Taxiway Y with parking for 21 cargo aircraft – 12 more spots than in Alternative 1 and two more than in Alternative 2.
- The North Airpark cargo facility is located in the North Airpark east of Taxiway R and south of Taxiway P and provides parking for eight cargo aircraft.
- The R Spots and North Terminal are not used for cargo aircraft parking in this alternative.

D.7.2 Parking Position Assignments

All airlines were assigned to use various Airport facilities:

- All passenger airlines were assigned to use the gates at the South and North Terminals. Airline gate assignments were flexible, so airlines were generally not limited to specific gates. This approach was acceptable for this assignment because a separate gating analysis was completed to evaluate the terminals and their ability to meet forecast demand in future years.

- Integrated carriers including FedEx and UPS were assigned to use the gates at their facilities. As with the passenger airlines, there was not a gate limit placed on these facilities, so all UPS and FedEx flights were able to use their respective facilities without any capacity limitations. This assumption was made to reflect that FedEx and UPS would develop additional aircraft parking positions on land they occupy if their existing facilities cannot accommodate their future schedules.

- Tech stop cargo parking areas varied between the alternatives. This helped the planners evaluate the ability to move cargo aircraft to and from cargo facilities planned in the South and West Airparks and to evaluate the potential removal of the existing R Spots, as evaluated in Alternative 2. There were substantive differences in the number of cargo

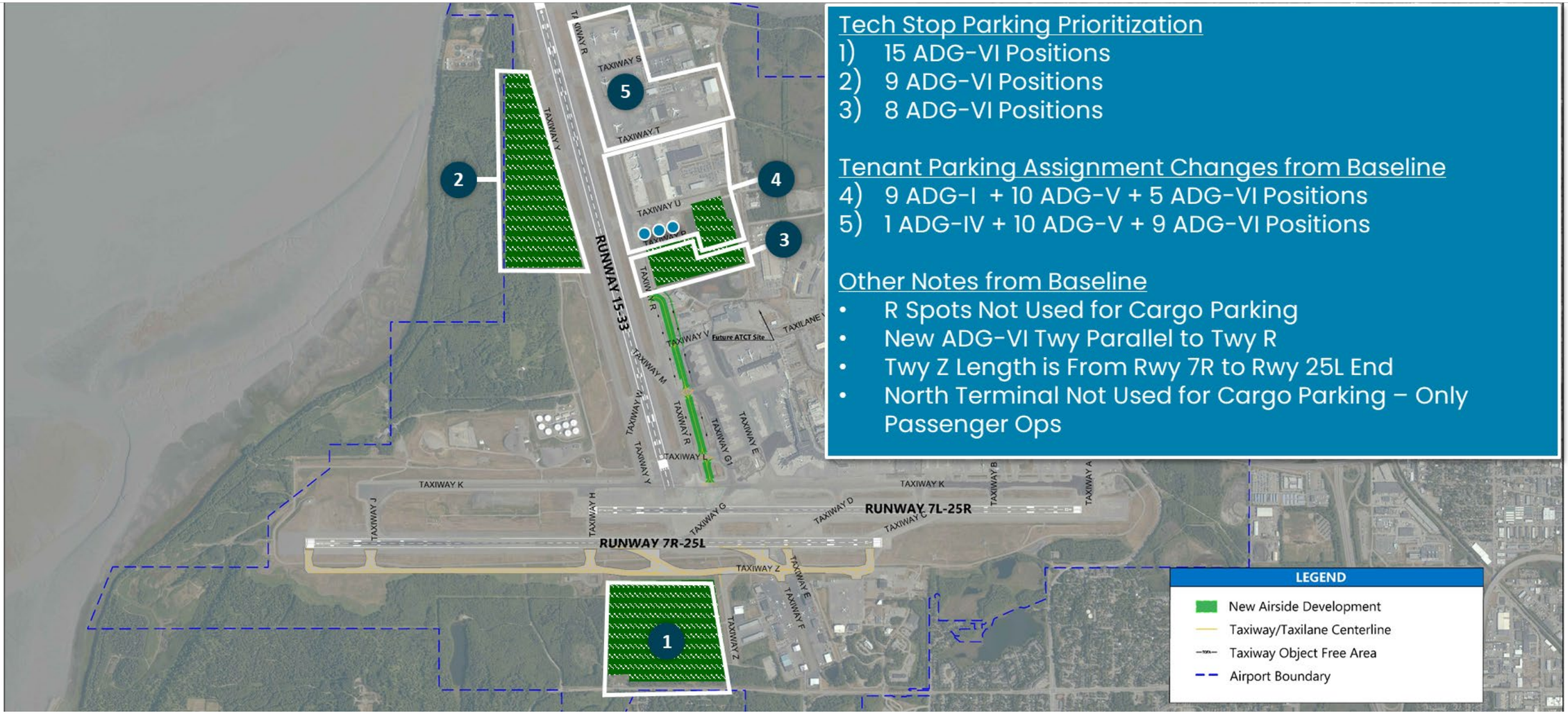
parking positions by location in the various alternatives. For example, Alternative 1 evaluated 15 cargo positions in the South Airpark, Alternative 2 evaluated no positions in the South Airpark and Alternative 3 evaluated six positions in the South Airpark. Likewise, West Airpark cargo aircraft parking varied between 9, 19, and 21 positions. All three alternatives provided more cargo parking positions dedicated to international air freight than the 29 positions determined to be required in the facility requirements analysis. Alternative 1 included 32 positions while Alternative 2 and Alternative 3 included 35 parking positions. This provided some flexibility to the model to move aircraft to the locations deemed to be more efficient for tech stop activity.

- Other airline activity, such as intrastate cargo, business aviation, and other miscellaneous activity were assigned to their respective locations such as the South Airpark, North Airpark, and East Airpark.

D.7.3 Aircraft Ground Movements

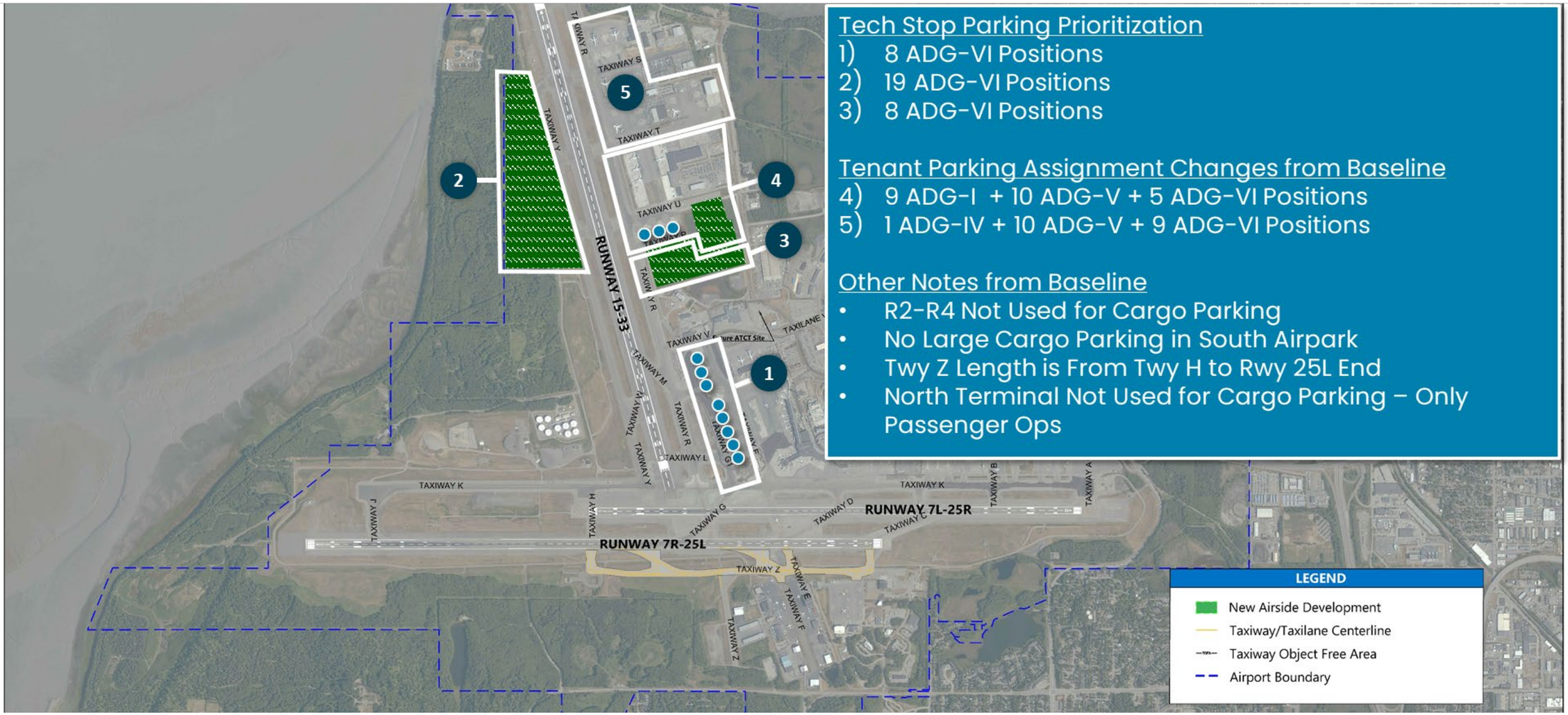
Aircraft ground movements and taxi routes generally followed those used from the baseline model calibration work done with air traffic control and Airport operations personnel. For future infrastructure, such as Taxiway Z, planners re-engaged with air traffic controllers and Airport operations to determine the likely routing they would use once new taxiways were available. Specific changes included routing of cargo aircraft to the planned South Airpark cargo facility. In each configuration, air traffic controllers identified the anticipated routes that would be assigned to arriving and departing aircraft as they move between their arrival runway, the South Airpark cargo facility, and the departure runway.

Figure D-8
Airfield Alternative 1 Scenario



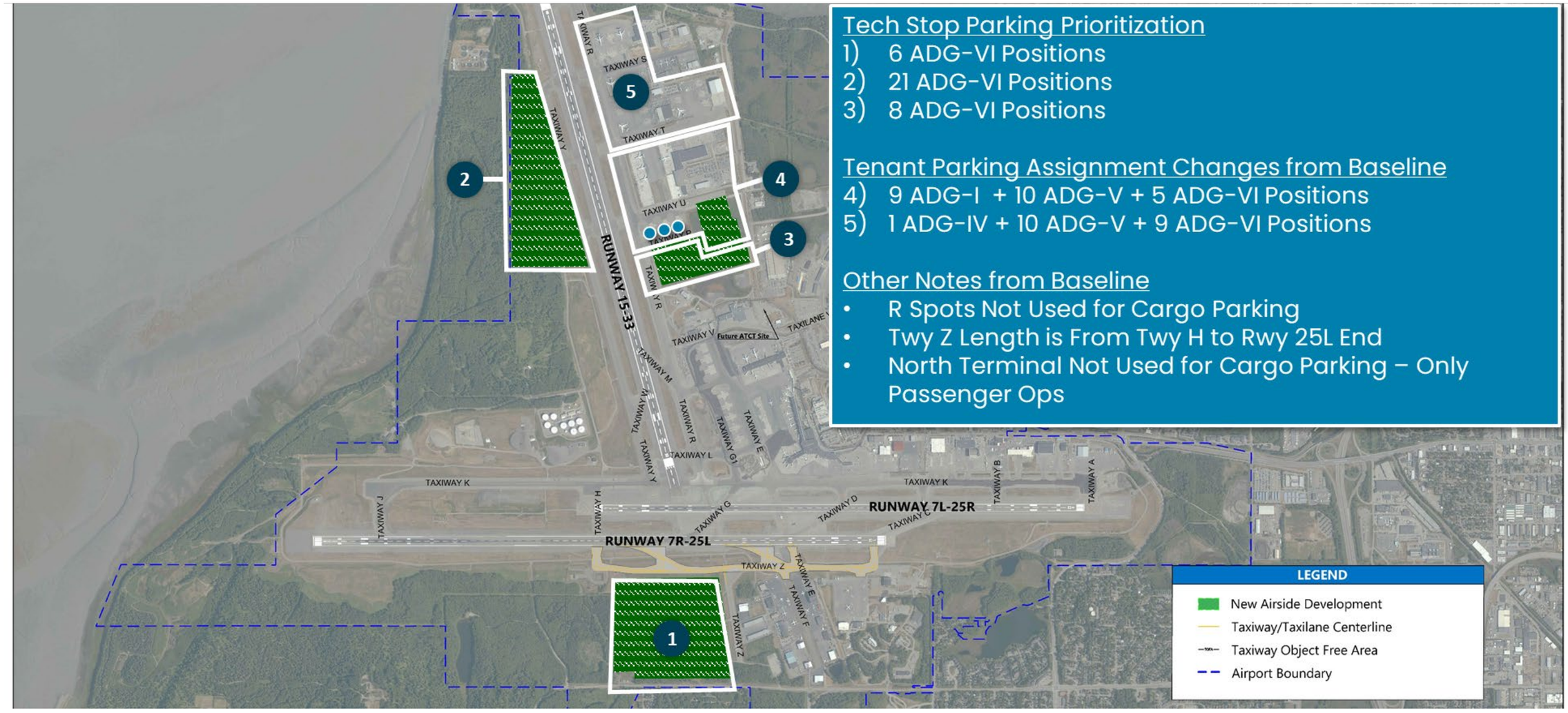
Source: RS&H, 2024

Figure D-9
Airfield Alternative 2 Scenario



Source: RS&H, 2024

Figure D-10
Airfield Alternative 3 Scenario



Source: RS&H, 2024

D.7.4 Simulation Results

The airfield simulation was conducted to evaluate the operational performance of three airfield alternatives relative to the PAL 3 Baseline. The simulations assessed aircraft throughput and delay under varying operational demand levels, configurations, and weather conditions. The alternatives only varied in two ways: the location of aircraft aprons for serving international cargo tech stops and adding additional taxiways at a location where the baseline analysis showed substantial taxiway congestion.

Results were summarized across peak-hour, average daily, and annualized delay metrics to inform comparative evaluation of the alternatives.

The following sections summarize and compare the simulation results for Alternatives 1, 2, and 3 based on the data presented in **Table D-3** and the corresponding alternative layouts illustrated in **Figure D-8**, **Figure D-9**, and **Figure D-10**.

D.7.4.1 Alternative 1

The Alternative 1 airfield simulation results are presented in **Table D-3**. Alternative 1 emphasizes redistribution of terminal-area cargo parking (the R Spots) to new tenant- and Airport-managed tech stop positions in the South Airpark, West Airpark, and North Airpark. This configuration is intended to relieve terminal area congestion while introducing a parallel taxiway to Taxiway R to improve terminal-area circulation.

Simulation results indicate that Alternative 1 achieves operational throughput comparable to the PAL 3 Baseline, with arrival and departure volumes remaining generally consistent across most demand scenarios. However, despite similar throughput, delay performance under Alternative 1 is worse than the baseline. Key findings include:

- Weighted average peak-hour delay increases to approximately 48.5 minutes, compared to 44.6 minutes under the PAL 3 Baseline.
- Average daily delay also increases relative to baseline conditions.
- Under higher-stress scenarios (notably Scenario 3 VMC), Alternative 1 exhibits substantial peak-hour departure delays, indicating sensitivity to demand concentration and limited resiliency during peak operations.

While Alternative 1 provides terminal-area congestion relief through redistribution of parking and added taxiway infrastructure, the simulation results suggest that these geometric and operational benefits do not translate into net delay reductions. The relatively constrained West Airpark cargo facility, with nine positions, appears to limit overall performance gains, particularly

during peak demand periods. Overall, Alternative 1 performs better than Alternative 3 but does not outperform the PAL 3 Baseline or Alternative 2 in delay metrics.

D.7.4.2 Alternative 2

The Alternative 2 airfield simulation results are described in **Table D-3**. Alternative 2 retains eight terminal-area RON positions while removing R2, R3, and R4. Alternative 2 also implements a shortened Taxiway Z that extends only from Taxiway H to the eastern end of the parallel runway – about half of the runway's length. This alternative represents a more conservative infrastructure approach, reflecting the assumption that South Airpark parking development is not implemented during this planning iteration.

Simulation results show that Alternative 2 provides the highest operational throughput of all evaluated alternatives, exceeding the PAL 3 Baseline as well as Alternatives 1 and 3. Increased throughput is evident across multiple demand scenarios, indicating improved capacity to process aircraft movements during peak conditions. This throughput advantage is accompanied by elevated delay metrics which reduce the alternative's feasibility, including:

- Weighted peak-hour delay of approximately 52.6 minutes, higher than both the baseline and Alternative 1
- Average daily and annual delays that exceed PAL 3 Baseline values
- Extreme delay conditions under Scenario 3 VMC, where peak-hour delays are substantially higher than those observed in Alternatives 1 and 3

The results suggest that while Alternative 2 enhances throughput by retaining terminal-area capacity, it does so at the expense of efficiency, resulting in increased congestion and delay accumulation during high-demand conditions. The shorter Taxiway Z limits circulation flexibility, and continued reliance on terminal-area parking contributes to localized bottlenecks. Alternative 2 performs best in terms of throughput but does not perform best overall when delay metrics are considered.

D.7.4.3 Alternative 3

The Alternative 3 airfield simulation results are described in **Table D-3**. Alternative 3 shifts development emphasis northward, heavily utilizing the West Airpark cargo facility along Taxiway Y with 21 cargo positions at this location. Alternative 3 also implements a limited version of South Airpark cargo facility and a shortened Taxiway Z. This alternative represents a more spatially constrained configuration with fewer circulation enhancements.

Simulation results indicate that Alternative 3 has operational throughput similar to the PAL 3 Baseline, but it performs the worst of the three alternatives in terms of delay. Key findings include:

- Highest weighted peak-hour delay among all alternatives, at approximately 64.9 minutes
- Average daily and annual delay metrics that exceed those of Alternatives 1 and 2
- Poor performance under both VMC and IMC peak scenarios, indicating limited robustness across operational conditions
- Highest peak delay in Configuration 1 VMC, the most common operating configuration

The concentration of cargo operations in the West Airpark, without commensurate increases in circulation or buffering capacity, results in increased queuing and reduced operational flexibility. This configuration appears particularly vulnerable to congestion during peak cargo activity periods. Alternative 3 is the lowest-performing alternative overall, with the highest delays and no meaningful throughput advantage.

D.8 Comparative Summary and Performance Ranking

Based on the simulation data and qualitative assessment of alternative layouts:

- Best throughput performance: Alternative 2
- Lowest delay among alternatives: Alternative 1
- Worst overall performance: Alternative 3
- Best overall balance of performance: PAL 3 Baseline

None of the evaluated alternatives demonstrate a clear improvement over the PAL 3 Baseline in terms of reducing average peak-hour or average daily delay. As noted in the Master Plan **Chapter 5, Alternatives** the AirTOP analysis does not provide conclusive evidence that implementation of these alternatives would reduce delay relative to baseline conditions.

The analysis also indicates that the proposed introduction of cargo aircraft parking in the South Airpark and West Airpark is unlikely to produce substantial operational delays that would not otherwise be experienced. In other words, as cargo demand increases beyond PAL 2 and approaches PAL 3, the ANC airfield is likely to experience airline defined untenable delay levels in excess of 30 minutes more than 10 percent of the time. The analysis generally supports the finding of the 2014 Master Plan, which indicated that annual operations beyond 260,000 will yield untenable delays during peak periods without an additional runway. This updated analysis indicates that locating new cargo facilities in the South Airpark and West Airpark is not likely to substantially change this finding.

At the conclusion of this Master Plan in early 2026, new cargo facilities have not yet been constructed in the South Airpark or West Airpark. Once new development is in place, it is recommended that ANC consider ongoing evaluation of air traffic control procedures for ground movement of aircraft and continued airfield performance modeling and evaluation to identify air traffic procedures and infrastructure improvements that may help maintain efficient operations as higher volumes of air traffic materialize.

Table D-3
Airfield Peak Hour Demand Capacity Results – Baseline and Airfield Alternatives

Operations Demand			**Configuration**	**Weather**	**Utilization**	**Operations Throughput**		**Average Peak Hour Delay** (minutes of delay per aircraft during peak hour)			**Average Daily Delay** (minutes of delay per aircraft during average day)			**Average Annual Delay** (annualized minutes of delay per aircraft)
Annual	Design Day	Rolling Peak Hr				Departure	Arrival	Departure	Arrival	Peak Total	Departure	Arrival	Peak Total	
PAL 3 Baseline														
325,775	1058	82	1	VMC	60%	37	46	44.3	7.6	50.2	4.5	1.3	5.9	**5.4**
			1	IMC	13%	39	43	36.7	21.6	58.2	4.3	2.8	7.1	
			2	VMC	21%	40	47	20.8	16.7	22.2	1.5	1.6	3.1	
			2	IMC	2%	35	46	72.5	30.0	91.1	9.3	1.7	10.9	
			3	VMC	1%	43	45	71.0	10.1	76.7	9.9	1.3	11.2	
			Weighted Delay (min)					**37.5**	**11.5**	**44.6**	**3.8**	**1.5**	**5.4**	
Alternative 1														
325,775	1,058	82	1	VMC	60%	37	46	51.1	10.5	56.6	5.8	1.4	7.3	**6.3**
			1	IMC	13%	41	43	45.9	10.3	51.7	5.5	1.5	7.0	
			2	VMC	21%	38	46	32.4	3.3	34.1	3.7	0.6	4.4	
			2	IMC	2%	46	49	8.4	7.9	10.5	0.9	0.7	1.6	
			3	VMC	1%	43	46	99.5	2.6	100.6	14.3	0.5	14.8	
			Weighted Delay (min)					**44.1**	**8.5**	**48.5**	**5.1**	**1.2**	**6.3**	
Alternative 2														
325,775	1,058	82	1	VMC	60%	45	46	20.2	30.4	42.9	2.4	3.0	5.3	**6.9**
			1	IMC	13%	43	43	35.6	24.7	55.2	4.7	2.6	7.3	
			2	VMC	21%	41	43	76.8	13.9	87.5	10.1	1.7	11.8	
			2	IMC	2%	39	49	20.6	12.7	22.4	1.8	1.7	3.5	
			3	VMC	1%	44	46	167.8	18.8	171.6	29.6	4.0	33.6	
			Weighted Delay (min)					**34.1**	**24.7**	**52.6**	**4.3**	**2.5**	**6.9**	
Alternative 3														
325,775	1,058	82	1	VMC	60%	39	46	64.9	9.4	73.2	7.6	1.6	9.2	**8.4**
			1	IMC	13%	39	43	53.9	5.5	58.8	5.3	1.1	6.3	
			2	VMC	21%	35	46	49.6	9.1	58.1	7.2	1.6	8.8	
			2	IMC	2%	40	49	23.1	7.2	25.2	1.8	1.4	3.2	
			3	VMC	1%	39	46	123.2	17.2	131.1	20.9	2.2	23.0	
			Weighted Delay (min)					**57.5**	**8.5**	**64.9**	**6.9**	**1.5**	**8.4**	

Source: RS&H Analysis, 2024